

What is claimed is:

1. A gas sensor comprising:

a main pumping means for pumping-processing oxygen
5 contained in a measurement gas introduced from external
space, comprising solid electrolyte contacting with said
external space, and an inner pumping electrode and an outer
pumping electrode formed on inner and outer surfaces of
said solid electrolyte; and

10 a measuring pumping means for decomposing a
predetermined gas component contained in said measurement
gas after being pumping-processed by said main pumping
means by the aid of a catalytic action and/or electrolysis,
and pumping-processing oxygen produced by said
15 decomposition via said outer pumping electrode of said main
pumping means, wherein:

a concentration of oxygen is controlled and/or the
predetermined gas component is measured by allowing a
pulse-shaped current to flow through said measuring pumping
20 means;

the gas sensor further comprising:

a electromotive force-measuring circuit for constantly
measuring the electromotive force corresponding to a
difference between an amount of oxygen produced by said
25 decomposition of said predetermined gas component and an
amount of oxygen contained in a reference gas;

a frequency control means for controlling a frequency

of said pulse-shaped current corresponding to a difference between an the electromotive force measured by said electromotive force-measuring circuit and a comparing voltage; and

5 a measuring circuit for at least converting the frequency of the pulse-shaped current into a concentration of said predetermined gas component.

10 2. The gas sensor according to claim 1, wherein a resistor is connected in series to a supply line of said pulse-shaped current to said measuring pumping means.

15 3. The gas sensor according to claim 2, wherein said resistor is selected or adjusted depending on performance of a sensor element.

4. The gas sensor according to claim 1, wherein said predetermined gas component is NOx.

20 5. A gas sensor comprising:
a main pumping means for pumping-processing oxygen contained in a measurement gas introduced from external space, comprising solid electrolyte contacting with said external space, and an inner pumping electrode and an outer
25 pumping electrode formed on inner and outer surfaces of said solid electrolyte; and

a measuring pumping means for decomposing a

predetermined gas component contained in said measurement gas after being pumping-processed by said main pumping means by the aid of a catalytic action and/or electrolysis, and pumping-processing oxygen produced by said decomposition via said outer pumping electrode of said main pumping means, wherein:

a concentration of oxygen is controlled and/or the predetermined gas component is measured by allowing a pulse-shaped current to flow through said measuring pumping means;

the gas sensor further comprising:

a electromotive force-measuring circuit for constantly measuring the electromotive force corresponding to a difference between an amount of oxygen produced by said decomposition of said predetermined gas component and an amount of oxygen contained in a reference gas;

a duty ratio control means for controlling a duty ratio of said pulse-shaped current corresponding to a difference between the electromotive force measured by said electromotive force-measuring circuit and a comparing voltage; and

a measuring circuit for at least converting the duty ratio of the pulse-shaped current into a concentration of said predetermined gas component.

6. The gas sensor according to claim 5, wherein a resistor is connected in series to a supply line of said

pulse-shaped current to said measuring pumping means.

5 7. The gas sensor according to claim 6, wherein said resistor is selected or adjusted depending on performance of a sensor element.

8. The gas sensor according to claim 5, wherein said predetermined gas component is NOx.

10 9. A gas sensor comprising:
a main pumping means for pumping-processing oxygen contained in a measurement gas introduced from external space, comprising solid electrolyte contacting with said external space, and an inner pumping electrode and an outer
15 pumping electrode formed on inner and outer surfaces of said solid electrolyte; and

a measuring pumping means for decomposing a predetermined gas component contained in said measurement gas after being pumping-processed by said main pumping
20 means by the aid of a catalytic action and/or electrolysis, and pumping-processing oxygen produced by said decomposition via said outer pumping electrode of said main pumping means, wherein:

25 a concentration of oxygen is controlled and/or the predetermined gas component is measured by allowing a pulse-shaped current to flow through said measuring pumping means;

the gas sensor further comprising:

a electromotive force-measuring circuit for constantly measuring the electromotive force corresponding to a difference between an amount of oxygen produced by said decomposition of said predetermined gas component and an amount of oxygen contained in a reference gas;

a crest value control means for controlling a crest value of said pulse-shaped current corresponding to a difference between the electromotive force measured by said electromotive force-measuring circuit and a comparing voltage; and

a measuring circuit for at least converting the crest value of the pulse-shaped current into a concentration of said predetermined gas component.

10. The gas sensor according to claim 9, wherein said concentration of oxygen is controlled and/or said predetermined gas component is measured by converting said pulse-shaped current having is converted into a voltage to detect said crest value.

11. The gas sensor according to claim 10, wherein a resistor is connected in series to a supply line of said pulse-shaped current to said measuring pumping means.

12. The gas sensor according to claim 11, wherein said resistor is selected or adjusted depending on

performance of a sensor element.

13. The gas sensor according to claim 9, wherein said predetermined gas component is NOx.

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14. A method for controlling a gas sensor,
the gas sensor comprising:

10 a main pumping means for pumping-processing oxygen contained in a measurement gas introduced from external space, comprising solid electrolyte contacting with said external space, and an inner pumping electrode and an outer pumping electrode formed on inner and outer surfaces of said solid electrolyte; and

15 a measuring pumping means for decomposing a predetermined gas component contained in said measurement gas after being pumping-processed by said main pumping means by the aid of a catalytic action and/or electrolysis, and pumping-processing oxygen produced by said decomposition via said outer pumping electrode of said main
20 pumping means;

wherein a concentration of oxygen is controlled and/or the predetermined gas component is measured by allowing a pulse-shaped current to flow through said measuring pumping means;

25 wherein the method for controlling the gas sensor comprises the steps of:

measuring constantly the electromotive force

corresponding to a difference between an amount of oxygen produced by said decomposition of said predetermined gas component and an amount of oxygen contained in a reference gas;

5 controlling a frequency of said pulse-shaped current corresponding to a difference between an the electromotive force measured by said electromotive force-measuring circuit and a comparing voltage; and

10 converting at least the frequency of the pulse-shaped current into a concentration of said predetermined gas component.

15 15. The method for controlling said gas sensor according to claim 14, wherein said predetermined gas component is NOx.

16. A method for controlling a gas sensor,
the gas sensor comprising:

20 a main pumping means for pumping-processing oxygen contained in a measurement gas introduced from external space, comprising solid electrolyte contacting with said external space, and an inner pumping electrode and an outer pumping electrode formed on inner and outer surfaces of said solid electrolyte; and

25 a measuring pumping means for decomposing a predetermined gas component contained in said measurement gas after being pumping-processed by said main pumping

means by the aid of a catalytic action and/or electrolysis,
and pumping-processing oxygen produced by said
decomposition via said outer pumping electrode of said main
pumping means;

5 wherein a concentration of oxygen is controlled and/or
the predetermined gas component is measured by allowing a
pulse-shaped current to flow through said measuring pumping
means;

10 wherein the method for controlling the gas sensor
comprises the steps of:

15 measuring constantly the electromotive force
corresponding to a difference between an amount of oxygen
produced by said decomposition of said predetermined gas
component and an amount of oxygen contained in a reference
gas;

 controlling a duty ratio of said pulse-shaped current
corresponding to a difference between an the electromotive
force measured by said electromotive force-measuring
circuit and a comparing voltage; and

20 converting at least the duty ratio of the pulse-shaped
current into a concentration of said predetermined gas
component.

25 17. The method for controlling said gas sensor
according to claim 16, wherein said predetermined gas
component is NOx.

18. A method for controlling a gas sensor,
the gas sensor comprising:

5 a main pumping means for pumping-processing oxygen
contained in a measurement gas introduced from external
space, comprising solid electrolyte contacting with said
external space, and an inner pumping electrode and an outer
pumping electrode formed on inner and outer surfaces of
said solid electrolyte; and

10 a measuring pumping means for decomposing a
predetermined gas component contained in said measurement
gas after being pumping-processed by said main pumping
means by the aid of a catalytic action and/or electrolysis,
and pumping-processing oxygen produced by said
decomposition via said outer pumping electrode of said main
15 pumping means;

wherein a concentration of oxygen is controlled and/or
the predetermined gas component is measured by allowing a
pulse-shaped current to flow through said measuring pumping
means;

20 wherein the method for controlling the gas sensor
comprises the steps of:

measuring constantly the electromotive force
corresponding to a difference between an amount of oxygen
produced by said decomposition of said predetermined gas
25 component and an amount of oxygen contained in a reference
gas;

controlling a crest value of said pulse-shaped current

corresponding to a difference between an the electromotive
force measured by said electromotive force-measuring
circuit and a comparing voltage; and

5 converting at least the crest value of the pulse-
shaped current into a concentration of said predetermined
gas component.

10 19. The method for controlling said gas sensor
according to claim 18, wherein said predetermined gas
component is NOx.